(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
24 June 2004 (24.06.2004)

PCT

(10) International Publication Number
WO 2004/053434 A3

(51) International Patent Classification?: E21B 43/10, 28/00, 29/10

(21) International Application Number: PCT/US2003/038550

(22) International Filing Date: 4 December 2003 (04.12.2003)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/431,184 5 December 2002 (05.12.2002) US

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(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States (*regional*): ARIPO patent (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),

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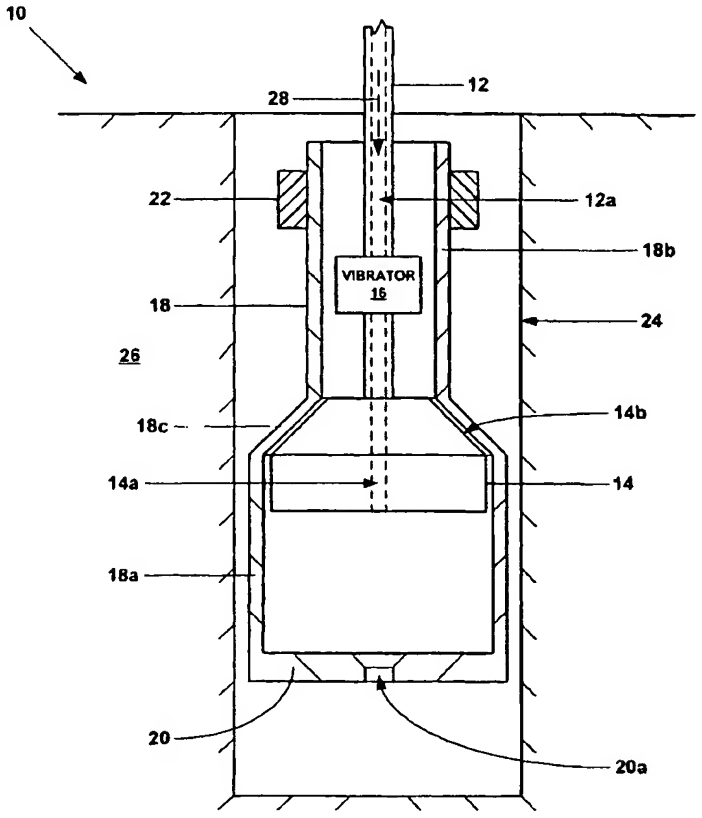
(54) Title: SYSTEM FOR RADIALLY EXPANDING TUBULAR MEMBERS



(57) Abstract: A system for radially expanding tubular members (18) includes an expansion device (14) and a vibratory device (16) that generates vibratory energy for agitating at least one of the expansion device (16) and/or the expandable tubular member (18).

WO 2004/053434 A3

Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Declaration under Rule 4.17:

— *of inventorship (Rule 4.17(iv)) for US only*

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
26 August 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US03/38550

A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : E21B 43/10, 28/00, 29/10
US CL : 166/207, 380, 177.6
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
U.S. : 166/207, 380, 177.6, 55.1, 277, 384, 206-217, 242.2

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
EAST: vibrator, tubular, expansion, frequency

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X,P --- Y,P	WO 03/064813 A1 (e2TECH LIMITED) 7 August 2003 (07.08.2003), pages 3-18.	1-8,15-37,46-70,79-110 --- 9-16,38-45,71-78
Y	US 4,384,625 A (ROPER et al) 24 May 1983 (24.05.1983), column 6, lines 50-54, figure 1.	9-16,38-45,71-78
X	US 4,204,312 A (TOOKER) 27 May 1980 (27.05.1980), column 2, lines 14-51, figure 1.	1,2,16,25,27,31,32,47,56,58,62-65,80,89,91,95,102,106-108
A	US 1,166,040 A (BURLINGHAM) 28 December 1915 (28.12.1915), page 1, lines 71-91.	1,31,64,102
A	US 6,464,014 B1 (BERNAT) 15 October 2002 (15.10.2002), column 5, lines 27-41.	1,31,64,102

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search
30 March 2004 (30.03.2004)

Date of mailing of the international search report
15 JUN 2004

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Form PCT/ISA/210 (second sheet) (July 1998)

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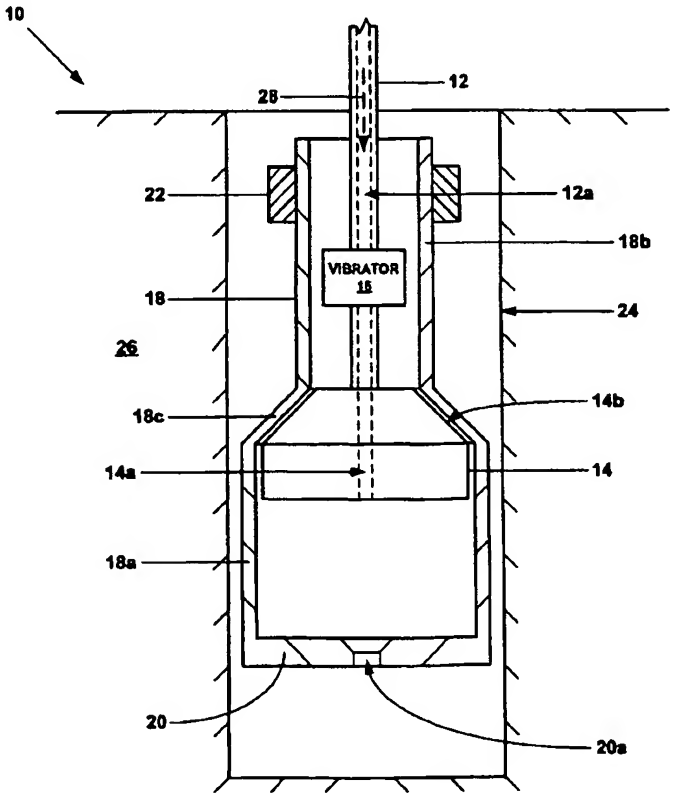
(54) Title: SYSTEM FOR RADIALLY EXPANDING TUBULAR MEMBERS



(57) Abstract: A system for radially expanding tubular members (18) includes an expansion device (14) and a vibratory device (16) that generates vibratory energy for agitating at least one of the expansion device (16) and/or the expandable tubular member (18).

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Declaration under Rule 4.17:
— *of inventorship (Rule 4.17(iv)) for US only*

Published:
— *with international search report*
— *with amended claims*

(88) Date of publication of the international search report:
26 August 2004

Date of publication of the amended claims: 16 December 2004

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

AMENDED CLAIMS
[received by the International Bureau on 11 August 2004 (11.08.2004);
new claims 111-147 added; remaining claims unchanged (24 pages)]

In the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application.

1. (Original) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device.

2. (Original) The apparatus of claim 1, wherein the expansion device comprises:

a tapered expansion cone.

3. (Original) The apparatus of claim 2, wherein the expansion device further comprises:

an actuator coupled to the tapered expansion cone for displacing the tapered expansion cone in an axial direction relative to the expandable tubular member.

4. (Original) The apparatus of claim 3, wherein the expansion device further comprises:

a locking device coupled to the actuator for fixing the position of the expandable tubular member relative to the actuator during the axial displacement of the expansion cone relative to the expandable tubular member.

5. (Original) The apparatus of claim 1, wherein the expansion device comprises:

a rotary expansion device.

6. (Original) The apparatus of claim 1, wherein the vibratory device is positioned within a non-expanded portion of the expandable tubular member.

7. (Original) The apparatus of claim 1, wherein the vibratory device is positioned within an expanded portion of the expandable tubular member.

8. (Original) The apparatus of claim 1, wherein the vibratory device is positioned within the expansion device.

9. (Original) The apparatus of claim 1, wherein the vibratory device comprises a plurality of vibratory devices.

10. (Original) The apparatus of claim 9, wherein at least one of the vibratory devices is positioned within a non-expanded portion of the expandable tubular member.

11. (Original) The apparatus of claim 10, wherein at least another one of the vibratory devices is positioned within an expanded portion of the expandable tubular member.

12. (Original) The apparatus of claim 10, wherein at least another one of the vibratory devices is positioned within the expansion device.

13. (Original) The apparatus of claim 11, wherein at least another one of the vibratory devices is positioned within the expansion device.

14. (Original) The apparatus of claim 9, wherein at least one of the vibratory devices is positioned within an expanded portion of the expandable tubular member.

15. (Original) The apparatus of claim 14, wherein at least another one of the vibratory devices is positioned within the expansion device.

16. (Original) The apparatus of claim 9, wherein at least another one of the vibratory devices is positioned within the expansion device.

15. (Original) The apparatus of claim 1, wherein the vibratory device comprises:
a fluid powered vibratory device.

16. (Original) The apparatus of claim 1, wherein the vibratory energy comprises:
vibratory energy in one or more planes.

17. (Original) The apparatus of claim 16, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.

18. (Original) The apparatus of claim 17, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.

19. (Original) The apparatus of claim 16, wherein the vibratory energy comprises:
vibratory energy in a plurality of planes.

20. (Original) The apparatus of claim 19, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.

21. (Original) The apparatus of claim 20, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having a plurality of center frequencies.

22. (Original) The apparatus of claim 1, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having one or more center frequencies.

23. (Original) The apparatus of claim 22, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having a plurality of center frequencies.

24. (Original) The apparatus of claim 1, wherein the magnitude of the vibratory energy is variable.

25. (Original) The apparatus of claim 1, wherein the magnitude of the vibratory energy is constant.

26. (Original) The apparatus of claim 1, wherein the plane of the vibratory energy is variable.

27. (Original) The apparatus of claim 1, wherein the plane of the vibratory energy is constant.

28. (Original) The apparatus of claim 1, wherein the expandable tubular member comprises a welbore casing.

29. (Original) The apparatus of claim 1, wherein the expandable tubular member comprises a pipeline.

30. (Original) The apparatus of claim 1, wherein the expandable tubular member comprises a structural support.

31. (Original) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device.

32. (Original) The method of claim 31, further comprising:

displacing the expansion device in an axial direction relative to the expandable tubular member during the radial expansion and plastic deformation.

33. (Original) The method of claim 32, further comprising:

fixing the position of the expandable tubular member relative to the expansion device during the axial displacement of the expansion device relative to the expandable tubular member.

34. (Original) The method of claim 31, further comprising:

rotating the expansion device during the radial expansion and plastic deformation of the expandable tubular member.

35. (Original) The method of claim 31, wherein the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member.

36. (Original) The method of claim 31, wherein the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.

37. (Original) The method of claim 31, wherein the vibratory energy is injected from a location within the expansion device.

38. (Original) The method of claim 31, wherein the vibratory energy is injected from a plurality of locations.

39. (Original) The method of claim 38, wherein at least some portion of the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member.

40. (Original) The method of claim 39, wherein at least another portion of the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.

41. (Original) The method of claim 39, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.

42. (Original) The method of claim 40, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.

43. (Original) The method of claim 38, wherein at least some portion of the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.

44. (Original) The method of claim 43, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.

45. (Original) The method of claim 38, wherein at least a portion of the vibratory energy is injected from a location within the expansion device.

46. (Original) The method of claim 31, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device comprises:
injecting fluidic materials into the expandable tubular member.

47. (Original) The method of claim 31, wherein the vibratory energy comprises:
vibratory energy in one or more planes.

48. (Original) The method of claim 47, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having one or more center frequencies.

49. (Original) The method of claim 48, wherein the vibratory energy comprises:
vibratory energy having a frequency distribution having a plurality of center frequencies.

50. (Original) The method of claim 47, wherein the vibratory energy comprises: vibratory energy in a plurality of planes.

51. (Original) The method of claim 50, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having one or more center frequencies.

52. (Original) The method of claim 51, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having a plurality of center frequencies.

53. (Original) The method of claim 31, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having one or more center frequencies.

54. (Original) The method of claim 53, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having a plurality of center frequencies.

55. (Original) The method of claim 31, wherein the magnitude of the vibratory energy is variable.

56. (Original) The method of claim 31, wherein the magnitude of the vibratory energy is constant.

57. (Original) The method of claim 31, wherein the plane of the vibratory energy is variable.

58. (Original) The method of claim 31, wherein the plane of the vibratory energy is constant.

59. (Original) The method of claim 31, wherein the expandable tubular member comprises a wellbore casing.

60. (Original) The method of claim 31, wherein the expandable tubular member comprises a pipeline.

61. (Original) The method of claim 31, wherein the expandable tubular member comprises a structural support.

62. (Original) The apparatus of claim 1, wherein the vibratory device coupled to the expansion device generates vibratory energy to agitate the expandable tubular member and the expansion device.

63. (Original) The method of claim 31, further comprising:
injecting vibratory energy into the expandable tubular member and the expansion device.

64. (Original) A system for radially expanding and plastically deforming an expandable tubular member, comprising:
means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and
means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device.

65. (Original) The system of claim 64, further comprising:
means for displacing the expansion device in an axial direction relative to the expandable tubular member during the radial expansion and plastic deformation.

66. (Original) The system of claim 65, further comprising:
means for fixing the position of the expandable tubular member relative to the means for displacing the expansion device during the axial displacement of the expansion device relative to the expandable tubular member.

67. (Original) The system of claim 64, further comprising:
means for rotating the expansion device during the radial expansion and plastic deformation of the expandable tubular member.

68. (Original) The system of claim 64, wherein the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member.

69. (Original) The system of claim 64, wherein the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.

70. (Original) The system of claim 64, wherein the vibratory energy is injected for a location within the expansion device.

71. (Original) The system of claim 64, wherein the vibratory energy is injected from a plurality of locations.

72. (Original) The system of claim 71, wherein at least some portion of the vibratory energy is injected from a location within a non-expanded portion of the expandable tubular member.

73. (Original) The system of claim 72, wherein at least another portion of the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.

74. (Original) The system of claim 72, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.

75. (Original) The system of claim 73, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.

76. (Original) The system of claim 71, wherein at least some portion of the vibratory energy is injected from a location within an expanded portion of the expandable tubular member.

77. (Original) The system of claim 76, wherein at least another portion of the vibratory energy is injected from a location within the expansion device.

78. (Original) The system of claim 71, wherein at least a portion of the vibratory energy is injected from a location within the expansion device.

79. (Original) The system of claim 64, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device comprises:

injecting fluidic materials into the expandable tubular member.

80. (Original) The system of claim 64, wherein the vibratory energy comprises: vibratory energy in one or more planes.

81. (Original) The system of claim 80, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having one or more center frequencies.

82. (Original) The system of claim 81, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having a plurality of center frequencies.

83. (Original) The system of claim 80, wherein the vibratory energy comprises: vibratory energy in a plurality of planes.

84. (Original) The system of claim 83, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having one or more center frequencies.

85. (Original) The system of claim 84, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having a plurality of center frequencies.

86. (Original) The system of claim 64, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having one or more center frequencies.

87. (Original) The system of claim 86, wherein the vibratory energy comprises: vibratory energy having a frequency distribution having a plurality of center frequencies.

88. (Original) The system of claim 64, wherein the magnitude of the vibratory energy is variable.

89. (Original) The system of claim 64, wherein the magnitude of the vibratory energy is constant.

90. (Original) The system of claim 64, wherein the plane of the vibratory energy is variable.

91. (Original) The system of claim 64, wherein the plane of the vibratory energy is constant.

92. (Original) The system of claim 64, wherein the expandable tubular member comprises a welbore casing.

93. (Original) The system of claim 64, wherein the expandable tubular member comprises a pipeline.

94. (Original) The system of claim 64, wherein the expandable tubular member comprises a structural support.

95. (Original) The system of claim 64, further comprising:
means for injecting vibratory energy into the expandable tubular member and the expansion device.

96. (Original) The apparatus of claim 19, wherein one of the planes is radial; and wherein another one of the planes is longitudinal.

97. (Original) The method of claim 50, wherein one of the planes is radial; and wherein another one of the planes is longitudinal.

98. (Original) The system of claim 83, wherein one of the planes is longitudinal; and wherein another one of the planes is radial.

99. (Original) The apparatus of claim 1, further comprising:
a vibratory device coupled to the expansion device for generating vibratory energy to impart rotation to the expansion device.

100. (Original) The method of claim 31, further comprising:

injecting vibratory energy into the expansion device to impart rotation to the expansion device.

101. (Original) The system of claim 64, further comprising:

means for injecting vibratory energy into the expansion device to impart rotation to the expansion device.

102. (Original) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member; and

means for reducing the required radial expansion forces during the radial expansion and plastic deformation of the expandable tubular member.

103. (Original) The apparatus of claim 1, wherein the vibratory device is adapted to impact the expandable tubular member.

104. (Original) The method of claim 31, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:

impacting the expandable tubular member.

105. (Original) The system of claim 64, wherein means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:

means for impacting the expandable tubular member.

106. (Original) The apparatus of claim 1, wherein the vibratory device is adapted to impact the expansion device.

107. (Original) The method of claim 31, wherein injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:

impacting the expansion device.

108. (Original) The system of claim 64, wherein means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device, comprises:

means for impacting the expansion device.

109. (Original) The method of claim 31, further comprising:

inserting the expansion device and the expandable tubular member into a preexisting structure; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device during the insertion.

110. (Original) The method of claim 31, further comprising:

removing the expansion device and the expandable tubular member from a preexisting structure; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device during the removal.

111. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate spherical surfaces.

112. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate elliptical surfaces.

113. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate hyperbolic surfaces.

114. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate surfaces that are faceted.

115. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate spherical surfaces.

116. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate elliptical surfaces.

117. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate hyperbolic surfaces.

118. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises one or more external arcuate surfaces that are faceted.

119. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the expansion device comprises a rotary expansion device.

120. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by rotating an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device.

121. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory device is positioned within an expanded portion of the expandable tubular member.

122. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a location within the radially expanded and plastically deformed portion of the expandable tubular member.

123. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory device is positioned within the expansion device.

124. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a location within the expansion device.

125. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory device comprises a plurality of vibratory devices.

126. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a plurality of discrete spaced apart locations.

127. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory energy comprises vibratory energy having a frequency distribution having a plurality of center frequencies.

128. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the vibratory energy comprises vibratory energy having a frequency distribution having a plurality of center frequencies.

129. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory energy comprises vibratory energy having a frequency distribution having a plurality of center frequencies; and

wherein the vibratory energy comprises vibratory energy in a plurality of planes.

130. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the vibratory energy comprises vibratory energy having a frequency distribution having a plurality of center frequencies; and

wherein the vibratory energy comprises vibratory energy in a plurality of planes.

131. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the plane of the vibratory energy is variable.

132. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the plane of the vibratory energy is variable.

133. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for generating vibratory energy to agitate at least one of the expandable tubular member and the expansion device;

wherein the vibratory energy has a center frequency of about 40 Hz.

134. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member by using an expansion device within the expandable tubular member; and

injecting vibratory energy into at least one of the expandable tubular member and the expansion device;

wherein the vibratory energy has a center frequency of about 40 Hz.

135. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device;

means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device; and

means for rotating the expansion device during the radial expansion and plastic deformation of the expandable tubular member.

136. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and

means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a location within the radially expanded and plastically deformed portion of the expandable tubular member.

137. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and

means for injecting vibratory energy into at least one of the expandable tubular member and the expansion device from a location within the expansion device.

138. (New) An apparatus for radially expanding and plastically deforming an expandable tubular member, comprising:

an expansion device movable in the expandable tubular member for radially expanding and plastically deforming the expandable tubular member; and

a vibratory device coupled to the expansion device for imparting rotation to the expansion device.

139. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

injecting vibratory energy into expansion device to impart rotation to the expansion device.

140. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

increasing the plasticity and formability of the expandable tubular before the radial expansion and plastic deformation of the expandable tubular member.

141. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and

means for increasing the plasticity and formability of the expandable tubular before the radial expansion and plastic deformation of the expandable tubular member.

142. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device; and

increasing the plasticity and formability of the expandable tubular during the radial expansion and plastic deformation of the expandable tubular member.

143. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device; and

means for increasing the plasticity and formability of the expandable tubular during the radial expansion and plastic deformation of the expandable tubular member.

144. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device;

injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and

during the radial expansion and plastic deformation of the expandable tubular member:

a) incrementing at least one of the plane, center frequency, and amplitude for the injected vibratory energy;

b) monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and

c) repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

145. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device;

means for injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and

means for during the radial expansion and plastic deformation of the expandable tubular member:

a) means for incrementing at least one of the plane, center frequency, and amplitude for the injected vibratory energy;

b) means for monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and

c) means for repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

146. (New) A method of radially expanding and plastically deforming an expandable tubular member, comprising:

radially expanding and plastically deforming the expandable tubular member using an expansion device;

injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and

during the radial expansion and plastic deformation of the expandable tubular member:

a) incrementing two or more of the plane, center frequency, and amplitude for the injected vibratory energy;

b) monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and

c) repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.

147. (New) A system for radially expanding and plastically deforming an expandable tubular member, comprising:

means for radially expanding and plastically deforming the expandable tubular member using an expansion device;

means for injecting vibratory energy into one or more of the expansion device and the expandable tubular member, wherein the injected vibratory energy is provided in an initial plane, has an initial center frequency, and has an initial amplitude; and

means for during the radial expansion and plastic deformation of the expandable tubular member:

a) means for incrementing two or more of the plane, center frequency, and amplitude for the injected vibratory energy;

b) means for monitoring the amount of energy required to continue the radial expansion and plastic deformation of the expandable tubular member; and

c) means for repeating steps a) and b) until the completion of the radial expansion and plastic deformation of the expandable tubular member.